dual-output, low-power thermostat

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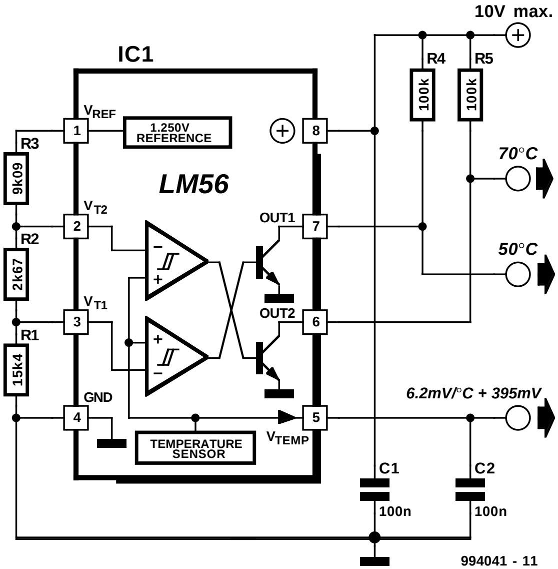


A National Semiconductor application

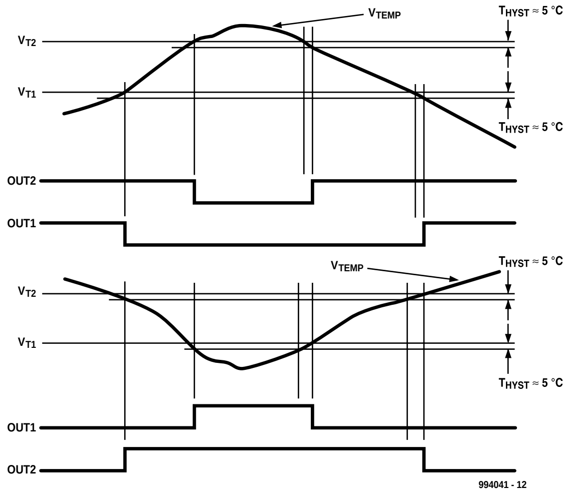
The LM56 from National Semiconductor is an accurate, dual-output, low-power thermostat contained in an 8-pin SMD case. It contains a 1.25 V bandgap voltage reference, two comparators with 5 °C hysteresis and a temperature sensor. The output voltage of the sensor is internally linked to the comparators. The supply voltage may lie in the range 2.7–10 V.

There are several variants: the LM56CIM has an accuracy of ±4 °C and the LM56BIM ±3 °C, both over the temperature range –40 °C to +125 °C. Typical applications are temperature monitoring in a variety of system, protection against low or high temperatures, and control of alarm systems or fans.

Outputs OUT1 and OUT2 are open-collector outputs, which can switch up to 5 mA (400 mV drop at 50 µA). If it is required to switch a higher current, a buffer stage is needed at the output. The outputs are enabled when the values set with R_1, R_2, and R_3 are exceeded—see the timing diagram. Resistors R_4 and R_5 are pull-up components.

The output voltage of the temperature sensor is 6.2 mV $°C^{-1}$ plus a fixed offset voltage of 395 mV. When the component values of potential divider R_1-R_2-R_3 are calculated, assume a load current of 50 µA for V_{REF}. This means that the total value of the three resistors is about 27 kΩ. If great accuracy is wanted, the bias current of the comparators should be taken into account, although the typical value of these is only 150 nA, so that they do not make much difference in practice. With values as specified in the circuit diagram, switching takes place at 50 °C and 70 °C.

Capacitor C_2 serves to decouple any interference. If such inter-



ference persists, the value of the capacitor may be increased to 1 µF without any adverse effect on the speed of reaction.

The LM56 draws a current of not more than 230 µA, which means that the total current drain, including the current through the potential divider, will not exceed 400 µA. This makes the IC particularly useful for systems operating from 3 V or 5 V battery packs.

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